

# FIBER BRAGG GRATING SENSOR DEMODULATORS



*Mach-Zehnder Interferometer*



*Fiber-Fabry Perot Interferometer*



*CCD Spectrometer*

The Naval Research Laboratory has developed a suite of technologies for reporting the strain fields detected by fiber Bragg grating (FBG) sensors. The sensors, which are encoded in single-mode optical fiber, are considerably smaller, lighter and less obtrusive than electrically based sensors, and are easily multiplexed to permit many locations to be monitored unambiguously through a single, lightweight lead to one instrument. Many essential engineering parameters are strain related, or can be transduced to strain, including stress and shape monitoring, acceleration, temperature and pressure.

Three instrumentation approaches that have been developed and demonstrated at NRL enable FBGs to equal or surpass the performance of traditional sensing technologies. The instrument of choice will be determined by the particular application requirements. To compare the NRL technology with conventional approaches, consider an application requiring strain measurement at 20 locations 10 meters from the instrumentation. With conventional resistance strain gages, 60 to 80 conductors would be led off to 20 amplifier "front-ends", with a typical noise level of ~10 microstrains, and a cabling mass of >1000 gms. Replacement with FBG sensors and the appropriate NRL demodulator design reduces the number of leads to as few as *one* optical fiber (< 1 gm) connected to a single instrument, with noise levels below one microstrain.

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